

## SECTION 16124

### MEDIUM-VOLTAGE CABLES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. This Section includes cables and related splices, terminations, and accessories for medium-voltage electrical distribution systems.

##### 1.3 SUBMITTALS

- A. Product Data: For each type of cable indicated. Include splices and terminations for cables and cable accessories.
- B. Samples: 16-inch (400-mm) lengths of each type of cable indicated.
- C. Qualification Data: For testing agency.
- D. Material Certificates: For each cable and accessory type, signed by manufacturers, certifying that cables comply with requirements specified in Part 2 Article "Source Quality Control."
- E. Field quality-control test reports.

##### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer of medium-voltage electrical cable to perform the installation specified in this section. Engage Installers who are experienced in cable splices and terminations for the specific types of cable and cable accessories specified in this Section. All persons engaged in preparing, splicing or terminating medium voltage cable shall be qualified. All splicers/terminators shall have be certified by and have a certificate from a school which teaches splicing and terminating of solid dielectric cable with the types of splices and terminations specified below.
- B. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise testing specified in Part 3.
- C. Source Limitations: Obtain cables and accessories through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with IEEE C2 and NFPA 70.

## 1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  1. Notify Project Officer at least five days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Architect's written permission.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Cables:
    - a. BICC Brand-Rex Company.
    - b. Kerite Co. (The); Hubbell Incorporated.
    - c. Okonite Company (The).
    - d. Pirelli Cables & Systems NA.
    - e. Rome Cable Corporation.
    - f. Southwire Company.
  2. Cable Splicing and Terminating Products and Accessories:
    - a. G&W Electric Co.
    - b. MPHusky.
    - c. Raychem Corp.; Telephone Energy and Industrial Division.
    - d. RTE Components; Cooper Power Systems, Inc.
    - e. Scott Fetzer Co. (The); Adalet, Inc.
    - f. Thomas & Betts/Elastimold.
    - g. 3M Company; Electrical Products Division.

## 2.2 CABLES

- A. General: Cable shall be single-conductor type, size and voltage as indicated. Cable shall conform to UL Standard 1072 Type MV-90, AEIC CS6, ICEA S-68-516, and ASTM B-8.
- B. Cable shall be ethylene propylene rubber (EPR) insulated.
- C. Conductor: Uncoated soft, Class B, stranded compressed concentric round. Copper shall conform to ASTM B-8. Electrical resistance shall meet requirements of ICEA S-68-516.
- D. Conductor Shield: Extruded layer of semiconducting thermosetting compound. The shield shall be clean stripping from the conductor and bonded to overlying insulation.
- E. Insulation: Shall be flexible thermosetting dielectric based on an ethylene propylene elastomer. The insulation shall limit degree of susceptibility to treeing experienced by crystalline materials. Insulation thickness at any cross-section of insulation shall not be less than 90% of the following minimum average thickness: 5 KV - 115 mil, 15 KV - 220 mil, 35 KV - 345 mil.
- F. Insulation Shield: Clean stripping extruded semiconducting compound applied over insulation. Electrical and physical requirements conforming to ICEA S-68-516, AEIC CS6 and UL 1072.
- G. Metallic Shielding: Copper shielding tape, 5 mil thick helically applied over the semiconducting insulation shield, with 12-1/2% overlap.
- H. Jacket: Shall be black, sunlight resistant polyvinyl chloride with minimum average thickness of 80 mil. Minimum thickness shall not be less than 64 mil.
- I. Operating Temperature: 90C continuous, 130C emergency, 250C short circuit.
- J. Production Tests: The cable shall be subject to the following tests: 1) conductor shall meet resistance requirements of ICEA S-68-516, 2) insulation resistance shall be tested in accordance with ICEA S-68-516 to be not less than 50,000 megohms - 1,000 feet, 3) high voltage AC and DC test performed per ICEA S-68-516, 4) full reel corona test performed per AEIC CS-6 (x-y recording graph shall be furnished showing test results).

## 2.3 SPLICE KITS

- A. Connectors and Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.
- B. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.
  - 1. Combination tape and cold-shrink-rubber sleeve kit with re-jacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
  - 2. Heat-shrink splicing kit of uniform, cross-section, and polymeric construction with outer heat-shrink jacket.
  - 3. Premolded, cold-shrink-rubber, in-line splicing kit.

4. Premolded EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.

## 2.4 SOLID TERMINATIONS

- A. Multiconductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.
  1. Compound-filled, cast-metal body, metal-clad cable terminator for metal-clad cable with external plastic jacket.
  2. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
  3. Heat-shrink sheath seal kit with phase- and ground-conductor re-jacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.
  4. Cast-epoxy-resin sheath seal kit with wraparound mold and packaged, two-part, epoxy-resin casting material.
- B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap for shielded cable terminations.
  1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
  2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.
  3. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief shield terminator; multiple-wet-process, porcelain, insulator modules; shield ground strap; and compression-type connector.
  4. Class 1 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, compression-type connector, and end seal.
  5. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.
  6. Class 3 Terminations: Kit with stress cone and compression-type connector.
- C. Nonshielded-Cable Terminations: Kit with compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.

## 2.5 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

- C. Load-Break Cable Terminators: Elbow-type units with 200-A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- D. Dead-Break Cable Terminators: Elbow-type unit with 600-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- E. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.
  - 1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
  - 2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
  - 3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
  - 4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.
- F. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.
- G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

## 2.6 ARC-PROOFING MATERIALS

- A. Tape for First Course on Metal Objects: 10-mil- (250-micrometer-) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.
- B. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, compatible with cable jacket.
- C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1/2 inch (13 mm) wide.

## 2.7 FAULT INDICATORS

- A. Indicators: Manual-reset fault indicator, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.
- B. Resetting Tool: Designed for use with fault indicators, with moisture-resistant storage and carrying case.

## 2.8 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to NEMA WC 7 before shipping.
- B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig (35 kPa).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install cables according to IEEE 576.
- B. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
  - 1. Where necessary, use manufacturer-approved pulling compound or lubricant that will not deteriorate conductor or insulation.
  - 2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips that will not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- D. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- E. Install direct-buried cables on leveled and tamped bed of 3-inch- (75-mm-) thick, clean sand. Separate cables crossing other cables or piping by a minimum of 4 inches (100 mm) of tamped earth. Install permanent markers at ends of cable runs, changes in direction, and buried splices.
- F. Install "buried-cable" warning tape 12 inches (305 mm) above cables.
- G. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables at intervals adequate to prevent sag.
- H. Install cable splices at pull points and elsewhere as indicated; use standard kits.
- I. Install terminations at ends of conductors and seal multiconductor cable ends with standard kits.
- J. Install separable insulated-connector components as follows:
  - 1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
  - 2. Portable Feed-Through Accessory: Three.
  - 3. Standoff Insulator: Three.
- K. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.
  2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
  3. Smooth surface contours with electrical insulation putty.
  4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
  5. Band arc-proofing tape with 1-inch- (25-mm-) wide bands of half-lapped, adhesive, glass-cloth tape 2 inches (50 mm) o.c.
- L. Seal around cables passing through fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."
- M. Install fault indicators on each phase where indicated.
- N. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
- O. Identify cables according to Division 16 Section "Basic Electrical Materials and Methods."

### 3.2 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
1. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
  2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 16124